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Perfil das Redes Multinível e Multidimensional em prol do Objetivo de Desenvolvimento Sustentável 9 (ODS 9) da Agenda 2030/ONU – Indústria, Inovação e Infraestrutura


Profile of Multilevel and Multidimensional Networks in support of Sustainable Development Goal 9 (SDG 9) of the 2030/UN Agenda - Industry, Innovation and Infrastructure

Perfil de las Redes Multinivel y Multidimensional para el Objetivo de Desarrollo Sostenible 9 (ODS 9) de la Agenda 2030/ONU – Industria, Innovación e Infraestructura


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PALAVRAS-CHAVE

Atores
governamentais e
não governamentais;
Modelo Multinível e
Multidimensional;
Parceria

Resumo: A Agenda 2030 incentiva um envolvimento global intensivo em apoio à implementação de seus Objetivos de Desenvolvimento Sustentável – ODS, ressaltando assim a formação de parcerias por meio de redes. Isso é válido tanto para a Agenda 2030 como um todo como também para objetivos específicos, como o ODS 9 que é voltado para a Indústria, Inovação e Infraestrutura. Este artigo visa identificar o perfil das redes formadas para o alcance do ODS 9, considerando o modelo multinível e multidimensional (MLMD) proposto por Park e Lim (2018). A coleta de dados foi realizada na *Sustainable Development Goals Partnerships Platform*. Os resultados apontam para uma grande pulverização de atores entre os



mais diversos níveis e dimensões, envolvendo atores governamentais e não governamentais em diferentes níveis hierárquicos. O maior número de atores identificados nos projetos é de atores não governamentais, com destaque ao setor privado. Apesar do seu reconhecido potencial, as transnacionais aparecem com uma tímida participação em projetos com vinculação ao ODS 9. Conclui-se que é necessário dinamizar os projetos e o ecossistema de parcerias para a implementação deste ODS, podendo inclusive se basear no modelo da tríplice hélice (empresa, governo e universidades), na hélice quádrupla (que inclui a sociedade à tríplice hélice) ou ainda a inclusão da variável ambiental (quíntupla hélice).

KEYWORDS

Governmental and non-governmental actors; Multilevel and Multidimensional Model; Partnership

Abstract: *The 2030 Agenda encourages intensive global engagement in support of the implementation of its Sustainable Development Goals – SDGs, emphasizing the formation of partnerships, and networks. This is valid for the 2030 Agenda as a whole and for specific objectives, such as SDG 9 focused on Industry, Innovation and Infrastructure. This article aims to identify the profile of the networks formed to achieve SDG 9 considering the multilevel and multidimensional model (MLMD) proposed by Park and Lim (2018). Data collection was made on the SDG Partnerships Platform. The results point to a large dispersion of actors among in diverse levels and dimensions, involving both governmental and non-governmental actors at different hierarchical levels. The largest number of actors identified are non-governmental actors, with emphasis on the private sector. However, despite their recognized potential, transnational companies appear with a timid participation in projects linked to SDG 9. It is conclude that is necessary to streamline projects and the ecosystem of partnerships for the implementation of this SDG, which may even be based on the model of the triple helix (company, government and universities), on the quadruple helix (which includes society in the triple helix) or even the inclusion of environmental variable (quintuple helix).*

PALABRAS CLAVE

Actores gubernamentales y no gubernamentales; Modelo multinivel y multidimensional; Alianzas

Resumen: *La Agenda 2030 fomenta un compromiso global intensivo en apoyo de la implementación de sus Objetivos de Desarrollo Sostenible – ODS, enfatizando la formación de alianzas por medio de las redes. Esto es válido para la Agenda 2030 en su conjunto y para objetivos específicos, como el ODS 9 centrado en Industria, Innovación e Infraestructura. Este artículo objetiva identificar el perfil de las redes formadas para alcanzar el ODS 9 y consideró el modelo multinivel y multidimensional (MLMD) propuesto por Park y Lim (2018). La recopilación de datos se llevó a cabo en la Sustainable Development Goals Partnerships Platform. Los resultados apuntan a una gran dispersión de actores gubernamentales y no gubernamentales en diferentes niveles jerárquicos. El mayor número de actores identificados son no gubernamentales, con énfasis en el sector privado. A pesar de su reconocido potencial, las transnacionales aparecen con una tímida participación. Se concluye que es necesario agilizar los proyectos y el ecosistema de alianzas para la implementación de este ODS, que incluso puede basarse en el modelo de la triple hélice (empresa, gobierno y universidades), en el de quádrupla hélice (que incluye a la sociedad en la triple hélice) o incluso la inclusión de variable ambiental (quíntupla hélice).*

Introduction

Global complexity and interdependence lead to the need to form global partnerships to face the challenges that lie ahead. This vision was strengthened after the Second World War, culminating in the emergence of the United Nations and its various agencies. Since then, various other bodies have been set up to promote cooperation in various fields, as well as bilateral and multilateral agreements, as well as initiatives by civil society and private entities. One of the most prominent actions is the 2030 Agenda for Sustainable Development, adopted by all UN Member States in 2015. This Agenda has 17 Sustainable Development Goals (SDGs) divided into 169 targets and 231 indicators (Van Tulder et al., 2021), with 3,008 events and 1,254 publications already being held, in addition to 5,390 registered actions (UN DESA, n.a.).

The 2030 Agenda highlights the importance of global partnership building, encouraging intensive engagement in support of the implementation of all SDGs and targets, bringing together governments, the private sector, civil society, the UN system and other actors (UN, 2015). This ultimately leads to the formation of multi-level and multi-dimensional partnerships. However, while this call for the Global Partnership has been met by several actors, by 2020 progress in implementing the SDGs has been slow, prompting the UN to announce the "Decade of Action". This is due to the slow or limited adoption and implementation of the 2030 Agenda, specifically by multinationals (MNCs), in close interaction with government policies, which turn out to be one of the main causes of the delay in the progress of the Agenda (Van Tulder et al., 2021).

Another point of concern with the implementation of the targets, is the emergence of the COVID-19 pandemic. While the 2030 Agenda is not without flaws and even before

the pandemic progress towards the SDGs was very slow, the pandemic presents itself as a test for the implementation of the targets (Jan Anton van Zanten & van Tulder, 2020). It is also worth noting that overall investment in the SDGs is below the \$2.5 trillion annual funding target for developing countries and that the COVID-19 shock has exacerbated existing SDG constraints and may hinder progress made over the past six years, posing a risk to meeting the 2030 Agenda (Zhan & Santos-Paulino, 2021).

Specifically on the 17 SDGs, they are characterized by integration and indivisibility, balancing three dimensions of sustainable development: economic, social and environmental (UN, 2015). In this sense, Sustainable Development Goal 9 (SDG 9) dedicated to Industry, Innovation and Infrastructure is recognized as a facilitator for other areas of the 2030 Agenda (e.g. economy and environment), and progress or otherwise in other areas can also affect it in various ways (Mantlana & Maoela, 2020) for example, progress in education can positively influence innovation.

Reinforcing this idea, a previous review identified that SDG 9 has been of great relevance, both for the recognition that activities, innovation and investments are drivers for job creation, economic growth and productivity, and for the close link between sustainability and innovation (Mio et al., 2020). This is mainly due to the importance of the private sector, investment and innovation as the main drivers of productivity, inclusive economic growth and job creation (UN, 2015). In addition, a link between sustainable development and innovation has been identified (Manocha & Srari, 2020; Sullivan et al., 2018; Vastola & Russo, 2021).

Therefore, in view of the importance of the Agenda in promoting Sustainable Development, especially in relation to SDG 9, as well as the challenges for its

implementation, it is relevant to understand and analyze the participation of the most diverse actors and the cooperation processes generated from the development of partnerships in support of the 2030 Agenda. In this sense, this article aims to identify the profile of the networks formed specifically for the achievement of SDG 9 - Industry, Innovation and Infrastructure.

This study aims to contribute with the various players to the uptake and participation in the implementation of the SDGs, since they are interconnected and indivisible. With a better understanding, these players will be able to choose partnerships with profiles that are more in line with their objectives and possibility of participation, contributing towards the attainment of the stipulated goals. In addition, the interactions between the SDGs should be well understood to develop integrative policies that differ strongly from country to country (Scherer et al., 2018). Thus, in seeking greater knowledge about the networks formed around SDG 9, it is intended to provide input for the elaboration of public policies with potential contribution to the fulfillment of SDGs.

In addition to this introduction, this article includes a review on SDG 9 and the formation of multi-level and multi-dimensional networks, the presentation of the methodology used in the development of this work, followed by the presentation of the results and discussions. Finally, the final considerations are set out.

Sustainable Development Goal 9 - Industry, Innovation and Infrastructure

Sustainable Development Goal 9 (SDG 9) aims at building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation (UN, 2015). To achieve this goal, the Agenda unfolds it into eight targets (Table 1). In this sense, SDG 9 aims to achieve socially inclusive and environmentally sustainable economic

development (Chasek et al., 2017), with industrialization, innovation and investment in infrastructure being identified as important drivers of economic growth (2017).

Through industrialization, there is an improvement in the productivity of the economy which, in turn, is the main source of long-term growth (Atkinson, 2013). Studies suggest that manufacturing and value-added activities that create jobs for the poor are effective in reducing poverty (Hull 2009; Rodrik 2013). Additionally, industry drives increased technology transfer, increased investment flows, skills development (Saieed et al., 2021), trade facilitation and promotion of resource efficiency (Kynčlová et al., 2020). However, there is no unanimity on these benefits. Economic growth, for example, is pointed to as a double-edged sword (J.A. van Zanten & van Tulder, 2021), as it can lead to improvements in living standards especially among the low-income population (Dollar et al., 2016) but it can also promote inequality within and between countries (Ravallion, 2001) and environmental degradation (J.A. van Zanten & van Tulder, 2021).

Table 1
Targets of SDG 9

Targets
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States
9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities
9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

Source: UN, 2015

Environmental and climate issues are raised along with another focus of SDG 9. The association between environmental degradation and technological advance may appear linked to issues of sustained economic growth, clean and accessible energy and quality education (Sinha et al., 2020). Thus, technological progress and innovation lead to transformations from the individual sphere to the level of supply chains and communities (Dantas et al., 2021). In this context, innovation is particularly relevant because the use of high technology can lead to more environmentally sustainable and less polluting processes (UNIDO, 2016) and better and more efficient use of resources (Denoncourt, 2020). In this way, science, technology and innovation are pointed out as a solution for environmental pressures (Giovannini et al., 2015). However, innovation goes beyond environmental issues, and sustainable development cannot be achieved without it (Silvestre & Țîrcă, 2019).

Environmental issues also appear in studies about infrastructure. One of these studies looks at the possibility of achieving SDG 9 without jeopardizing SDG 14 (Life

below water) and SDG 15 (Life on Land), presenting the necessary policy transformations to mitigate the impacts of infrastructure on biodiversity (zu Ermgassen et al., 2019). The infrastructure also has a social impact, as its expansion can be important in alleviating poverty and economic growth (Agénor & Moreno-Dodson, 2006; Donaldson, 2018), as well as generating positive impacts on education and health (2017).

Thus, with the relevance of SDG 9 for sustainable development, the formation of cooperation networks is important. The next session is about multilevel, multidimensional cooperation networks.

Multilevel and Multidimensional Cooperation Networks

Thinking of a world of profound transformations, governmental and non-governmental entities end up forming networks of different forms and intensities of relationship. With specific reference to interstate relations and to the search for effective forms of international interaction, the networks have already proved to be one of the most effective standards of cooperation. International networks, informal, flexible, stable, cooperative, multi-level and pluralistic have been promoting a new architecture of world politics in the 21st century (Kuznetsov, 2020).

The term "network" can be conceptualized in different ways. It can be generally conceptualized as a set of nodes/entities and relationships that connect them, or it can be defined as a group of interdependent actors oriented to a common goal (tangible or intangible) that none of these actors could achieve on their own with the same effectiveness (Alter & Hage 1993; Isett et al. 2011). The units/actors or nodes of the networks can be individuals or any aggregation of individuals, such as a group, an organization,

a community, or even a nation-state (Fombrun, 1982). Specifically, in this study, we will consider the organizational networks that can be defined as representations of connections between organizations or organizational units (Ahuja et al., 2012). At this level of interorganizational analysis, the unit is the organization itself or a sectorial set, and the network maps the flows between these units (Fombrun, 1982).

Within these networks, it should be noted that relationships among organizations do not happen only within their area of activity or only between peers. In this way, networks are inevitably multilevel and multidimensional structures (Park & Lim, 2018). Starting from this understanding, in their study, the authors propose a multi-level and multi-dimension network model (MLMD) (Figure 1).

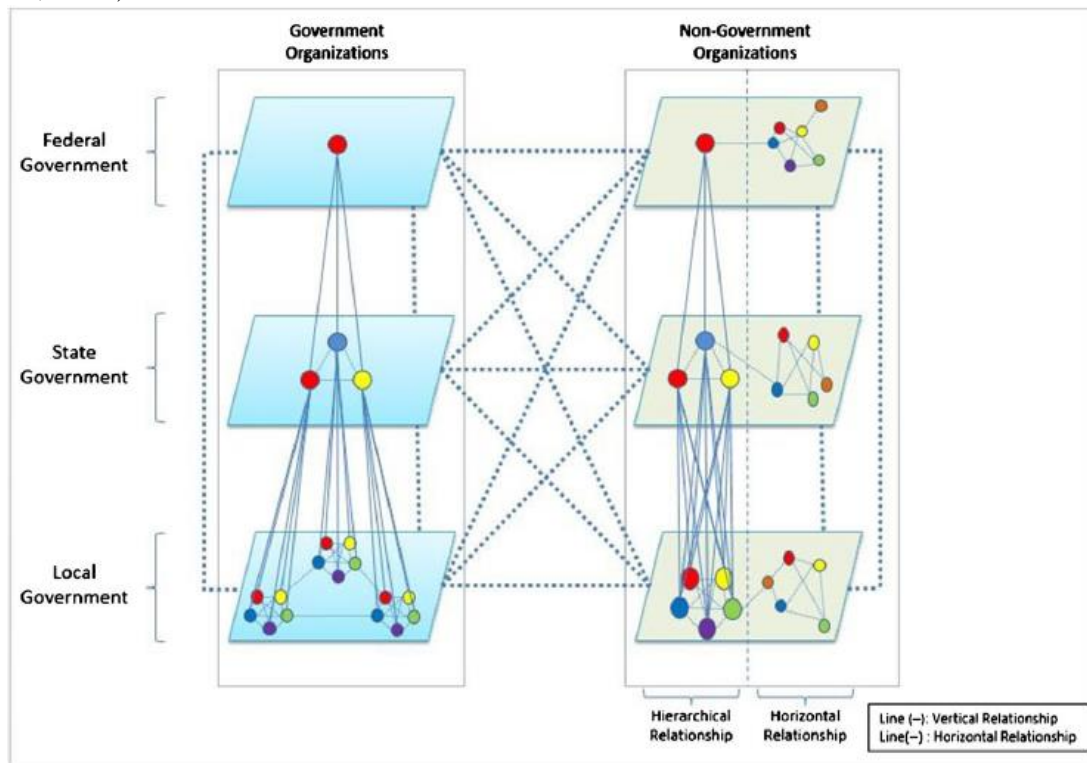


Figure 1
Conceptual map of multi-level and multi-dimension network model (MLMD)
Source: Park e Lim (2018)

This dynamic view is useful, since it is unlikely that all participants in the network have the same hierarchical level (Agranoff & McGuire, 2001). This is easily visualized among state entities, since there is a distribution of power at various levels, such as federal, state and municipal. Non-state actors often build their organization hierarchically to maximize their operational efficiency or achieve their organizational goals. Since they do not have an inherent hierarchical structure,

and have the prerogative of freely structuring their form of organization, they may present more or less levels than the three presented in the MLMD model (Park & Lim, 2018). It is worth highlighting that, in a multi-level structure, the participants in the network are dispersed on different levels (Hooghe & Marks, 2003).

Regarding multidimensionality, Park and Lim (2018) consider two sectors in their study: government (based on legal mandates) and non-governmental (other entities such as non-profit organizations, private companies, associations and interest groups). Thus, when actors from different sectors (public and

private) interact with each other, the network incorporates cross-sectoral relationships and the network structure becomes multi-dimensional (Park & Lim, 2018). Finally, the authors propose that these actors can have intersectional, interlevel and within-level relationships, as shown in Figure 1.

This type of multi-level approach in the analysis of networks was used by other authors. One of the studies focuses on the collaborative networks formed around the vaccine against the influenza virus in the period from 2006 to 2013 (Liu et al., 2018). The authors worked with an analytical structure of various dimensions, considering the national, municipal and institutional levels. This multi-level analysis was useful to the study as it allowed a broader understanding of international scientific collaboration in the field of influenza vaccine, enabling different levels of government to extract information to drive policies to promote international collaborative research to increase disease prevention capacity. Another study involved the bibliometric analysis and multidimensional multilevel network analysis considering the country, city, institutions and academia levels to follow the evolution and trends of cooperation in entrepreneurship research, as well as the characteristics of international academic cooperation between the years 2009 and 2018 (Song et al., 2019).

In this way, the multilevel and multidimensional approach is useful in analyzing the networks formed in favor of the implementation of the Sustainable Development Goals (SDGs), since these networks involve state entities at the most diverse levels as well as non-governmental actors such as organized civil society entities, non-governmental organizations, intergovernmental organizations, citizens among others.

Methodological elements of research

To achieve the research objective, the qualitative approach with descriptive nature is used. In view of the diversity of sectors and levels of partners involved in the cooperation processes around SDGs, this study was chosen to combine documentary research with the multi-level and multi-dimensional model (MLMD) proposed by Park and Lim (2018) to analyze SDG 9 - Industry, Innovation and Infrastructure. The data analysis technique used was content analysis. The procedures were divided into two stages.

The first step was to collect data on the projects registered on the Sustainable Development Goals Partnerships Platform (United Nations, n.a.). At the time of data collection (March/2021), there were 533 projects, four of which were registered in duplicate, one project was registered three times and one did not present any information. After excluding these cases, the database now has 526 projects whose data has been compiled for Excel. Data such as project name, scope, description, status, partners, and time data such as start date, end date, and duration forecast were extracted.

In the second stage, after completing the compilation, the initial treatment of the data was carried out in order to standardize them minimally (for example, cases in which the same actor appeared with and without accent were adjusted and the separation of the actors within each project). Afterwards, the partners were properly categorized based on the MLMD. Initially, 3,810 partners were visualized, but after the analysis started, it was found that many project managers informed partners in a generalist way, such as "Government Actors", "B2B Business", "Organized Civil Society", "Provincial Councils", "Members of Parliament" and "Governmental Organizations". These cases were excluded as they would not be useful for

the analysis of the networks formed, leaving 2,936 players who were duly classified. Then, descriptive analyzes of the projects were carried out, identifying the combinations of SDGs in the projects and analyzing the actors mentioned in each of the projects. The results are presented in the next session.

Presentation and discussion of results

The projects are registered and updated on the platform by the partners themselves. As an illustration, Figure 2 is presented bringing in numbers the temporal movement of actions related to SDG 9 registered on the platform. Although the 2030 Agenda was approved in 2015, some projects (25.5% of all projects) were started before this approval, which did not make it impossible to link to the SDGs and then register on the platform. However, as expected, the volume of projects increased from 2015 onwards, with 2017 being the year with the highest volume of project insertion.

From the partners' inclusion and update, the platform generates status for each of the actions. These statuses are summarized and

presented in Table 2. Most projects (61%) appear with *Inactive* status. However, it should be noted that they are not necessarily paralyzed, since the system classifies them as such when there are no updates made by the partners on time. The second status with the highest incidence is *Uninformed* which includes registered actions whose *reports* have not yet occurred but are within the update deadline (usually one year).

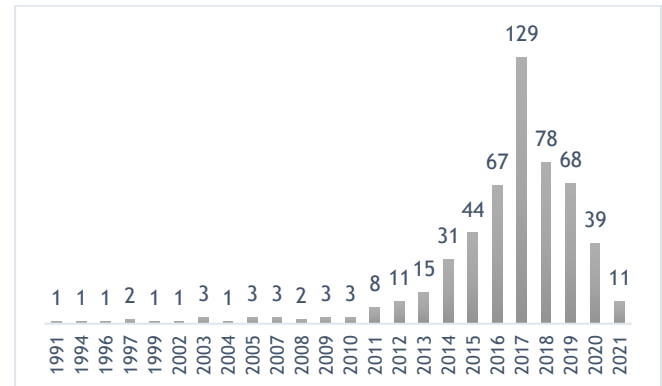


Figure 2
Time movement of registered actions on the platform
Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

Table 2
Estimated time of project and status registered on the platform

Estimated Time	Inactive	Off track	On track	Financial Issues	Completed	Uninformed	Total
0-2 years	107		6	1	6	57	177
3-6 years	76		20		3	37	136
7-9 years	20		2	1	1	11	35
10 years or more	77	1	11	1	4	22	116
Undetermined	43		7		1	11	62
Total	323	1	46	3	15	138	526

Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

Note. The explanations of each status are given below. Inactive: Projects considered inactive because they do not receive update information. Off track: projects that have reporting by partners but are outside the planning stipulations. On track: there is an update on the progress of the partnership and the project is moving forward as expected. Financial Issues encompasses projects that have problems with funding. Completed: Partnerships/projects already finalized. Uninformed: registered actions whose reports have not yet occurred, but are within the update deadline

Because statuses are defined from *reporting* or not from project progress information within the set time period, some actions may exhibit platform inconsistency. It

is therefore important to cross-check with the planned deadlines. Table 3 presents a new status, now considering the expected execution time. According to the planned implementation

dates, 33% of the projects would already have been finalized, however, if considering the status reported on the platform (Table 2), only a little less than 3% would have been finalized. This may indicate that part of the projects may be incorrectly classified by the platform due to lack of update by partners.

Table 3
Status from the expected execution time

Estimated time	Ended Period	Period to End	Total
0-2 years	126	51	177
3-6 years	40	96	136
7-9 years	7	28	35
10 years or more	2	114	116
Undetermined		62	62
Total	175	351	526

Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

Most projects (99.0%) cover other SDGs together with SDG 9, with only 5 registered projects considering only SDG 9 (Table 4), this is consistent in view of the fact that SDGs are interlinked and indivisible. The most frequent combination of SDGs (128 projects) involves all 17 Objectives. The second largest combination (10 projects) involves SDG 9 together with 15 other SDGs (except SDG 14 Life below Water). Other more frequent combinations involve combining SDG 9 with SDG 8 Decent Work and Economic Growth (5 projects), SDG 9 and SDG 11 Sustainable Cities and Communities (5 projects), SDG 9 and SDG 14 Water Life (5 projects) and SDG 9 together with SDG 14 Life below Water and 17 Partnerships for the Goals (5 projects). The other combinations are sprayed.

Table 4
Number of SDGs considered in projects

SDG	# Projects	%
Only SDG 9	5	1,0%
2 SDGs	27	5,1%
3 SDGs	33	6,3%
4 SDGs	46	8,7%
5 SDGs	49	9,3%
6 SDGs	43	8,2%
7 SDGs	35	6,7%
8 SDGs	27	5,1%
9 SDGs	20	3,8%
10 SDGs	17	3,2%
11 SDGs	25	4,8%
12 SDGs	18	3,4%
13 SDGs	14	2,7%
14 SDGs	15	2,9%
15 SDGs	8	1,5%
16 SDGs	16	3,0%
All of 17 SDGs	128	24,3%
Total de Projetos	526	100,0%

Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

Profile analysis of formed networks

The results regarding the classification of the actors involved in the implementation of the SDGs are presented in Table 5. One can see that the private sector had the largest number of mentions (644). The predominance of private sector actors is in line with the recognized relevance of these players in implementing the SDGs (Mio et al., 2020). This is because actors from the private sector can contribute by providing financing, in addition to their sector-specific experience and knowledge, managerial and supervisory skills along with a greater willingness to take risk (Berrone et al., 2019). This importance is even highlighted in the SDGs, and target 12.6 is directed to encourage companies to adopt sustainable practices and include this sustainability information in their reports (UN, 2015).

Table 5
Classification of Actors involved in projects

Actors	Rating	Number of Actors
Private Sector	Non-Governmental	644
Non-Profit		
Organizations/NGOs	Non-Governmental	377
UN-related entities	Governmental	316
Academic		
Institutions	Non-Governmental	303
Governmental		
Institutions	Governmental	303
Governments	Governmental	224
Local/Regional		
Governments	Governmental	187
Intergovernmental		
Organizations	Governmental	179
Organized Civil		
Society	Non-Governmental	149
Philanthropic		
organizations	Non-Governmental	81
Educational		
Institutions	Non-Governmental	63
Scientific		
Community	Non-Governmental	47
International		
Organizations	Non-Governmental	39
Citizens	Non-Governmental	24
Grand Total		2,936

Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

The second set of actors that received the most mentions is non-profit organizations/NGOs (377). These actors engaged in a series of important public policy debates, and their activism was responsible for major changes in behavior and corporate governance (The Economist, 2003) being recognized as important *stakeholders* in other studies involving ODS (Bruns et al. 2019; Escher & Brzustewicz 2020; Nakidien et al. 2021; Vanderslott 2019). Among government actors, UN agencies or entities are the most representative among the actors involved with SDG 9. This is consistent in view of the involvement of these bodies in the preparation

of the 2030 Agenda as well as their action in favor of forming partnerships for the implementation of the SDGs.

Academic institutions and intergovernmental organizations are also relevant (303 players each). Academic institutions in a special way, are pointed out as relevant in view of their role as an agent of social change to make more sustainable business through research, teaching and public engagement (Meglio, 2020). Intergovernmental organizations, on the other hand, end up reinforcing the state's leading role in the solution of global problems. Finally, large international collaborative arrangements play an emerging role and need to involve different sectors such as government, industry and academia that remain important actors, but connectivity, links and associations with other institutional actors and agencies are no less important (Heitor et al., 2014).

The *players* most mentioned in each of the categories of the governmental dimension are presented in Table 6. Governments were included in the Nation States category mentioned in the platform. In Government Institutions, institutions formed from government agents at the national level and in Intergovernmental Organizations, organizations formed between countries at the international level were classified. Although the UN system is also formed from intergovernmental relations, the separation was opted for, given the relevance of these entities in the scope of implementing the SDGs. Finally, Regional/Local Governments included state, municipal, provincial and local governments. The item Others is the sum of the other actors and was included to demonstrate the spraying of actors within each category. It can be highlighted here that the networks are formed by actors at the most diverse levels, with emphasis on nation states, along with

regional/local governments.

Table 6 shows, as expected, the prevalence of the mention of participation of developed nations and their institutions in the implementation of SDG 9. Four of the five governments that appear most in projects on the platform are in Europe. This result is in line with that found in the previous study (Mio et al., 2020). These developed nations also stand

out in the categories of intergovernmental organizations (attention to the European Union) and regional/local governments. Nevertheless, it is worth highlighting the presence of Embrapa - Brazilian origin and the Ministry of Earth Sciences - Indian government, which are institutions of emerging nations.

Table 6
Most cited partners in each category of the government dimension

Governments	Governmental Institutions	Intergovernmental Organizations	Regional/Local Governments	UN Entities	
Sweden	12 United States Agency for International Development (USAID)	6 European Union	25 Local Governments for Sustainability (ICLEI)	5 United Nations Development Programme (UNDP)	36 United Nations Educational, Scientific and Cultural Organization (UNESCO)
France	8 EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária)	4 Global Environment Facility (GEF)	9 Brest Métropole	3 County of Hawai'i	21 United Nations Environment Programme (UNEP)
Finland	7 Ministry of Earth Sciences (India)	4 Secretariat of the Pacific Regional Environment Programme (SPREP)	7 County of Kaua'i	3 World Bank Group	20 United Nations Industrial Development Organization (UNIDO)
Germany	7 NOAA - National Oceanic and Atmospheric Administration	4 Organisation for Economic Cooperation and Development (OECD)	6 County of Maui	3 Others	19 Others
Japan	7 National Aeronautics & Space Administration (NASA)	3 Secretariat of the Pacific Community (SPC)	6 Others	170 Total	187 Total
Others	183 Others	282 Others	126 Others	170 Total	199 Total
Total	224 Total	303 Total	179 Total	187 Total	316 Total

Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

Table 7 presents the main actors mentioned in each category of the non-governmental dimension. Academic institutions were included in the category of higher education institutions, in Organized Civil Society civil society organizations, non-profit organizations/NGOs, non-profit institutions and non-governmental

organizations, and finally, Private Sector covers for-profit businesses and institutions. In each of the categories, the item Others was included so that it was possible to visualize the spraying of actors in each one of them.

The categories Citizens (citizens involved in the projects), Educational Institutions (informal education institutions and

educational institutions, except higher education), International Organizations (multilateral organizations with participation of governments, civil society, private initiative acting at the international level), Philanthropic Organizations (foundations and institutions dedicated to charity) and Scientific Community (research institutes and institutions) did not present any prominent players, therefore they were not included in the table.

The participation of non-governmental entities prevails in the development of SDG 9 projects (59% of the total actors involved).

Among the Academic Institutions that were most mentioned in projects on the platform, most come from developed countries, which is in line with the previous result on the prevalence of developed nation-state involvement. Organized Civil Society entities include those that focus on environmental issues. Non-Profit Organizations/NGOs are also important agents of sustainable transformation, with the world-famous WWF being the most mentioned. Here again, we note the prevalence of focus on environmental issues.

Table 7
Most cited partners in each category of the non-governmental dimension

Academic Institutions		Organized Civil Society		Non-Profit Organizations/NGOs		Private Sector	
UBO - Université de Bretagne Occidentale	7	World Silambam Association (WSA)	6	World Wide Fund for Nature (WWF)	11	IBM	4
University of the South Pacific (USP)	5	Hawai'i Conservation Alliance	3	Conservation International	7	Impact Global Emission Solutions Ltd. (IGES)	3
Tokyo University	4	Hawai'i Green Growth	3	The Nature Conservancy	7	Kyo-Ya Hotels & Resort	3
University of Hawaii	4	Agricultural Leadership Foundation of Hawaii	2	World Resources Institute (WRI)	5	Microsoft	3
Stanford University	3	Eastern Fishermen's Federation (GP/UG)	2	AIESEC	3	The Conscious Fashion Campaign	3
Others	280	Others	133	Others	344	Others	628
Total	303	Total	149	Total	377	Total	644

Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

Also, within this level, the participation of the private sector stands out, equivalent to 22% of the total of the partners involved and 37% within the category. However, based on the results, these actors are very fragmented, and IBM was pointed out in the largest number of projects (4). It should be noted that several other multinationals have been mentioned, albeit on a smaller number of occasions. On the one hand, it is noted that these large corporations are involved in a small number of

projects for SDG 9, which falls short of the potential for participation in view of their capacity to provide resources. On the other hand, this spraying is not necessarily negative, given that the private sector is the category with the highest number of actors involved in projects. Thus, it can be concluded that there are a wide variety of organizations committed to implementing SDG 9.

Finally, it is worth analyzing the types and combinations of actors within the projects

(Table 8). It can be observed that 44.30% of the projects are developed by just one type of player and that 293 projects (55.70% of the total of projects) are developed by two or more types of actors. The government, at its most diverse levels, is the actor with the largest number of projects, in isolation (88 projects) and is the actor that appears in the most projects, either alone or in conjunction with other types of actors (293 projects, which corresponds to 55.70% of the total of projects). This reinforces the idea of government leadership when it comes to sustainable development. However, we must highlight the Academy's participation with 34 projects in isolation (169 projects when we analyze

together with other types of actors) and the private sector with 32 projects in isolation (173 projects when we analyze together with other types of actors).

When one analyzes partnerships with only two types of players, the most frequent one is between Government and International Organizations. This combination of partnership is also repeated with the inclusion of other players such as Non-Governmental Organizations (NGOs) (10 projects with three types of players), the Academy (nine projects with three types of players) and the Private Sector (seven projects with three types of players).

Table 8
Types of actors in projects

Actors	Projects
Only one type of actor	233
Government	88
Academy	34
Private Sector	32
Non Governmental Organizations (NGOs)	28
Civil Society	26
International Organizations (IOs)	25
Two types of actors	147
Government + International Organizations (IOs)	40
Government + Private Sector	21
Private Sector + Non Governmental Organizations (NGOs)	13
Private Sector + Academy	12
Government + Academy	11
Government + Non Governmental Organizations (NGOs)	11
Academy + Non Governmental Organizations (NGOs)	10
Government + Civil Society	6
International Organizations (IOs) + Non Governmental Organizations (NGOs)	6
Academy + International Organizations (IOs)	5

Private Sector + International Organizations (IOs)	5
Private Sector + Civil Society	3
Non Governmental Organizations (NGOs) + Civil Society	2
Academy + Civil Society	1
International Organizations (IOs) + Civil Society	1
Three types of actors	75
Government + Academy + NGOs	10
Government + International Organizations (IOs) + NGOs	10
Government + Academy + International Organizations (IOs)	9
Government + Private Sector + International Organizations (IOs)	7
Government + Private Sector + Academy	6
Private Sector + Academy + NGOs	5
Government + Private Sector + NGOs	4
Private Sector + NGOs + Civil Society	4
Governo + Academy + Civil Society	3
Government + NGOs + Civil Society	3
Private Sector + International Organizations (IOs) + NGOs	3
Academy + NGOs + Civil Society	2
Government + Private Sector + Civil Society	2
Private Sector + Academy + International Organizations (IOs)	2

Academy + International Organizations (IOs) + NGOs	1
Academy + International Organizations (IOs) + Civil Society	1
Government + International Organizations (IOs) + Civil Society	1
International Organizations (IOs) + NGOs + Civil Society	1
Private Sector + Academy + Civil Society	1
Four types of actors	37
Government + Private Sector + Academy + NGOs	8
Government + Private Sector + International Organizations (IOs) + NGOs	6
Government + Academy + International Organizations (IOs) + NGOs	4
Private Sector + Academy + International Organizations (IOs) + NGOs	4
Academy + International Organizations (IOs) + NGOs + Civil Society	3
Government + Private Sector + NGOs + Civil Society	3
Government + Academy + NGOs + Civil Society	2
Government + Private Sector + Academy + International Organizations (IOs)	2
Government + Academy + International Organizations (IOs) + Civil Society	1

The partnership between three types of players was identified in 75 projects (14.26% of the total of projects). If we analyze this from the point of view of the triple helix, which involves companies, government and academia, the result found is not very representative, since it was identified that this triple partnership appears in only six projects (1.14% of the total number of projects). From the perspective of the quadruple helix (including a triple helix society) and considering non-governmental organizations (NGOs) as social manifestations, we have eight projects. If we move to the five-propeller (including the environmental dimension to the quadruple propeller), only one project (included in the category of Five Types of Actors) involving Fiji's government agencies, the private sector such as the Fiji Pearl

Government + International Organizations (IOs) + NGOs + Civil Society	1
Government + Private Sector + International Organizations (IOs) + Civil Society	1
Private Sector + Academy + NGOs + Civil Society	1
Private Sector + International Organizations (IOs) + NGOs + Civil Society	1
Five types of actors	28
Government + Private Sector + Academy + IOs + NGOs	11
Government + Private Sector + Academy + NGOs + Civil Society	9
Government + Academy + IOs + NGOs + Civil Society	4
Government + Private Sector + IOs + NGOs + Civil Society	3
Private Sector + Academy + IOs + NGOs + Civil Society	1
Six types of actors	6
Government + Private Sector + Academy + IOs + NGOs + Civil Society	6
Total	526

Source: authors based on data from Sustainable Development Goals Partnerships Platform (2021)

Association, the University of the South Pacific (USP), the Locally Managed Marine Area Network appointed as a civil society organization in the project and, finally, institutions focused on environmental issues such as the World Wide Fund for Nature (WWF) and the Wildlife Conservation Society were identified.

Finally, it is worth highlighting that only six projects involve the six types of actors categorized in this study (Government + Private Sector + Academy + IOs + NGOs + Civil Society), which represents only 1.14% of the total of projects analyzed. The results found indicate that there is a great opportunity for the formation of more multidimensional partnerships.

Final Considerations

The present study sought to analyze the networks formed in favor of SDG 9 Industry, Innovation and Infrastructure. The results point to a great spraying of actors between the most diverse levels and dimensions. The 526 projects analyzed involved both governmental and non-governmental actors at different hierarchical levels, with 55.70% of the projects involving two or more types of actors. This result is in line with what was advocated by the 2030 Agenda regarding the formation of global partnerships involving different actors, but it shows that there is room for the development of multidimensional partnerships. It is also worth highlighting that, although state entities have normally been regarded as primordial in the resolution of global problems and have stood out in terms of the number of projects in which they participate, when we analyze the absolute numbers of players identified in the projects registered on the platform, the largest volume is of non-governmental actors, with emphasis on the private sector.

Within this category, despite the recognized potential of companies in the quest for sustainable development, the major transnational companies appear with a timid participation in projects with links to SDG 9. However, we do not need to place the weight of achieving the objectives on just one type of actor. Projects and partnership ecosystems need to be boosted for the implementation of this SDG and can even be based on the triple helix model (company, government, and universities), the quadruple helix (which includes the triple helix society) or even the inclusion of the environmental variable (five-helix) that appear in a rather timid way in the results found.

Data from the Sustainable Development Goals Partnerships Platform were used for the

study. This platform is powered by the players themselves, which has led to one of the main limitations of the study: the lack of data update and standardization. For example, some projects appear with an expected end date that has already been finalized, but do not have a status of "Complete", since the end was not confirmed by the actor on the platform. Another limitation is related to the issue of lack of standardization with some fields not being filled in or inadequately filled in. There is the use of general terms such as "B2B Business" or "Government Actors" that do not specify what they would be. Additionally, the platform does not offer the possibility to export the data. This made the work mostly manual. Future research may circumvent these limitations by using cross-platform data with other sources such as the website of organizations mentioned in the projects.

Future research may also broaden the scope of the research to other SDGs, besides expanding the analysis of the structure of the micro-networks formed (in each one of the projects) and of the network. In this sense, network structure indicators could be explored, such as density and centrality.

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